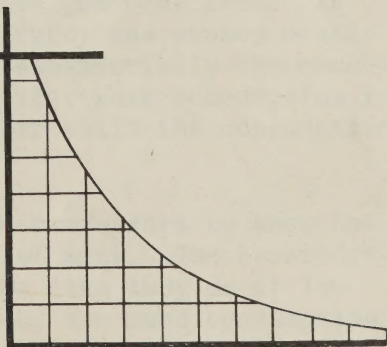


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THE DEMAND FOR MEAT IN CANADA

by
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CANADA DEPARTMENT OF AGRICULTURE

Marketing Service

Economics Division

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THE DEMAND FOR MEAT IN CANADA

The 14,000,000 people in Canada each eat between 100 and 150 pounds of meat a year. Total consumption amounts to about 1.5 billion pounds a year and is the market for 80 per cent of the meat produced on Canadian farms. Meat is an important part of the diet of domestic consumers. It is one of the staple foods. However, when meat supplies are low and prices are high there is some substitution of non-meat foods such as fish, poultry and eggs. It is by this means that smaller supplies are distributed or rationed among consumers. On the other hand, when meat supplies are large greater consumption is encouraged by lower prices.

Beef and pork are the most important kinds of meat eaten in Canada. During the prewar period 1935-39 about one half of the total meat consumed was beef, a little more than one-third pork, about ten per cent veal, and five per cent lamb. In addition there were small amounts of fancy and canned meats consumed. During the postwar period substantially the same consumption pattern prevailed except that pork consumption increased to about the same level as beef while the consumption of other meats declined.

It is of interest to farmers and processors to know how consumers react to changes in prices of meat. The knowledge that consumers buy less at high prices than they do at low prices is not sufficient. Some idea of how much consumption changes with a given change in price is also important for answering many questions involved in policy making.

If it can be assumed that there exists a routine in the demand behaviour of human beings in the market and that routine has persisted over a period of time, it would be possible to observe the results in the market. The result of the behaviour of consumers in masses in the market is the quantity of a commodity actually sold in the market during a given period of time and the price at which this quantity was sold. The total quantity and the price at which it was sold represents, on the one hand, the aggregate quantity consumers were willing to buy

at that price and, on the other hand, the aggregate quantity sellers were willing to sell at that price. Each observed market price and quantity sold results from the interaction of supply and demand. Numerous observations are necessary for deriving a general relationship between quantity purchased and price - for approximating a demand curve.

The relationship between the quantity and price of a commodity purchased may be obscured by a number of factors such as growth of the consuming population, changes in the value of money (purchasing power of the commodity), changes in the quantity of money consumers have available for spending, and changes in prices of other goods and services. These factors may be said to cause the demand for a given commodity to shift. That is, the whole schedule of quantities and corresponding prices is increased or decreased by a given amount without disturbing that net relationship between quantity and price (elasticity).

Shifts in demand resulting from the increase in population were removed from the data by expressing quantity and consumers' ability to purchase goods and services on a per capita basis. Prices were expressed in terms of dollars of constant purchasing power to remove from the data effects of shifts in demand resulting from changes in the value of money. Shifts in the demand for meat resulting from changes in consumers' ability to buy goods and services were isolated by means of multiple correlation analysis. This is the relationship between the quantity and price of meat purchased, holding constant the number of consumers, their ability to purchase goods and services, and the purchasing power of money.

Consumers' response to price changes was studied by observing over a period of time the quantities of meat purchased in Canada and the prices at which it was purchased. Each observation covered a 12 month period September to August which is a livestock marketing and supply year. The annual quantity purchased was computed by adjusting government inspected production of pork, beef, veal and lamb for changes in storage stocks, imports and exports. Inspected meat production is one half to three-quarters of total output; it is the only meat which can enter interprovincial and international trade, and it is the part of total output which varies in magnitude as

marketings vary. Non-inspected meat production varies much less from year to year because it is sold in local markets where total demand remains relatively steady.

Average annual prices were computed by weighting monthly wholesale carcass prices by monthly consumption of each kind of meat. Average retail prices for each kind of meat are not available. Thus it is the demand of retail dealers which is being measured here.

Prices are expressed in terms of dollars, the value of which varies considerably from year to year. One method of showing the purchasing power of meat in terms of all other commodities and services is to divide the wholesale price of meat by the general wholesale price index. This is a price in terms of dollars of constant purchasing power, or a "real" price.

It has been assumed that habit and custom are largely responsible for a fairly stable relationship between the quantity of meat consumers buy per person and the "real" prices they will pay for different quantities. If, however, consumers' incomes increase, there is a tendency to be willing to pay a higher set of prices for varying quantities of meat than formerly. The reverse is true when incomes fall. It is possible by means of multiple correlation analysis to measure the relationship between the quantity of meat purchased per capita and the average "real" price, segregating the influence of changes in consumers' incomes.

Consumers' ability to purchase goods and services varies with industrial production. A time series of monthly industrial production in index form was averaged to the September to August marketing year basis. This measure of consumers' ability to buy was selected instead of one of the several measures of income from national income estimates because the latter are compiled on a calendar year basis only and are not adaptable to a livestock marketing year basis.

Data are available from September 1926 to date. However, the disruptions to marketing caused by wartime price and consumption controls made it advisable to cover the period only to August 1942. The relationship which prevailed during the 16

year period 1926-1927 to 1941-1942 is the one which is being studied here.

The regression equation is

$$\log.X_1 = 1.9438 - 1.5390 \log.X_2 + 1.0118 \log.X_3$$

in which X_1 = weighted average wholesale price of all meat divided by the general wholesale price index.

X_2 = average domestic consumption per capita of all meat.

X_3 = the index of industrial production per capita reflecting consumers' ability to purchase goods and services.

The relation being studied is that between the "real" price of meat and the quantity consumed per capita. Allowance has been made in the data for shifts in demand resulting from changes in the general price level and from population growth. Shifts in demand resulting from changes in consumers' ability to purchase meat, as reflected by an index of physical volume of industrial production representing real income, are measured in the regression analysis.

The regression equation may be interpreted as follows: Assuming the value of money, the number of consumers, and the ability of consumers to purchase goods and services remain constant, an increase of one per cent in the domestic consumption of meat is associated with a decrease of 1.54 per cent in the wholesale price per pound.

In this equation the deflated price per pound was expressed as a function of domestic consumption per capita and industrial production per capita. Variations in the first variable were associated with variations in the other two. The completeness of the association between the first and the other two is in the order of 90 per cent. That is, during the period 1926-1927 to 1941-1942, variations in the per capita consumption of meat and the per capita industrial production were associated with

90 per cent of the variations in the average "real" wholesale price of all meat.

Price elasticity of demand is a term used to denote the relationship between proportional changes in quantity purchased and proportional changes in price. Demand is said to be elastic with respect to price if a unit proportional change in quantity demanded is associated with a less than unit proportional change in price. It is said to be inelastic when a unit proportionate change in quantity demanded is associated with a greater than unit proportionate change in price. The standard reference for elasticity is unity. This is the particular case in which a unit proportional change in quantity purchased is associated with a unit proportional change in price.

The price elasticity of demand computed from the equation is .65 ($e = \frac{dX_2}{dX_1}$). According to the standard reference of unity the price elasticity of demand for all meat is inelastic. That is, a proportionate change in quantity demanded is associated with a relatively larger proportionate change in price.

There are three important conditions commonly recognized as influencing price elasticity of demand. First, those commodities for which there are many substitutes have a more elastic demand than those for which there are few important substitutes. Second, those commodities for which there are many uses, or which may be substituted for many other commodities, have a more elastic demand than those with fewer uses. Third, the greater the expenditure on the commodity relative to the purchaser's income, the greater the elasticity of demand is likely to be.

A consideration of these conditions with respect to the price elasticity of the demand for meat leads to the conclusion that the results obtained above are valid. Meat is a broad class of food which is a staple in the diets of Canadians. It is neither a substitute for other foods nor are there any important substitutes to supplant it permanently or even to any great extent. Finally, the proportion of consumers' incomes spent for meat is not likely to be any greater than about eight per cent judging from the weights allotted to meat in consumer's cost of living indexes.

The price elasticity of demand refers to a dealers' demand. Prices are those paid to wholesalers. A different elasticity would be expected if retail prices were used in the analysis instead of wholesale prices. This is because the retail margin changes only slightly when wholesale prices change as a result of changes in supply. The addition of a relatively inflexible margin to a relatively flexible wholesale price results in larger proportional changes in quantity being associated with a unit proportional change in price, and hence a higher elasticity of demand at retail. This has been estimated at 1.05. By a similar line of reasoning it can be shown that the deduction of relatively inflexible processing and transportation charges from wholesale prices results in a lower price elasticity of demand, on a carcass basis, at the farm. This has been estimated at .40.

An explanation of differences in price elasticity of demand for meat on a carcass basis, at retail, at wholesale, and at the farm, lies in the availability and effectiveness of substitutes for meat. The meat packing industry has developed a certain capacity for slaughtering livestock, processing and selling meat. One of their greatest problems is maintaining plant operations at an optimum level. They find it necessary to purchase and process livestock even though prices rise. There is a relatively low response of quantity to price at this early stage of marketing (elasticity .40).

Retailers, on the other hand, are usually less specialized in their physical and organizational establishment. They find it possible to substitute more readily other commodities for meat when prices rise due to a decline in supply. There is a greater response to price change (elasticity .65).

Consumers buy meat as one of several kinds of food. Even though meat may be an important part of the diet and the habit of buying and eating meat is very strong in Canada, there are a number of satisfactory substitutes for meat. Poultry, fish and eggs may take the place of meat in the average home to a greater extent than usual when prices for meat rise. There is then a much greater response to price changes on the part of the final consumer (elasticity 1.05).

Table 1.- Price and Consumption of Meat, and Industrial Production in Canada, 1926-1927 to 1941-42

Marketing year Sept. 1 to Aug. 31:	a/ Price ¢ per lb.	b/ Quantity lb.	Industrial production per capita 1935-39 = 100
1926-27	12.2	73.0	102.6
1927-28	13.2	70.8	108.6
1928-29	15.2	71.4	120.2
1929-30	15.4	70.1	105.8
1930-31	13.9	65.9	86.7
1931-32	9.9	68.1	70.9
1932-33	8.9	67.3	63.5
1933-34	10.5	70.1	79.8
1934-35	10.8	69.4	84.5
1935-36	11.1	75.1	93.1
1936-37	11.1	81.7	104.6
1937-38	12.5	77.0	103.4
1938-39	12.8	77.0	102.6
1939-40	12.1	84.2	119.9
1940-41	12.5	89.8	141.2
1941-42	14.2	96.8	168.6

a/ Average wholesale carcass price per pound, Winnipeg, deflated by general wholesale price index (1926 = 100).

b/ Domestic consumption per capita of all inspected meat.

Source: Prices - Monthly Bulletin of Agricultural Statistics, Dominion Bureau of Statistics.

Production of Meat - Health of Animals Division, Canada Department of Agriculture.

Imports and Exports of Meat - Trade of Canada, Dominion Bureau of Statistics.

Index of Industrial Production - Monthly Bulletin of Business Statistics, Dominion Bureau of Statistics.

General Wholesale Price Index - Prices and Price Indexes, Dominion Bureau of Statistics.

TECHNICAL APPENDIX

The choice of variables was limited by availability of data which was adaptable to the problem. The response of consumers to changes in meat prices could not be studied directly because there are no estimates of average retail prices of the various kinds of meats. The retail price data which are available refer to selected cuts only. These series are not fully representative of the various kinds of meat carcass nor are they consistent in the kind of cut reported in all cases. For these reasons wholesale carcass prices were used to reflect consumers' response to price changes.

The quantity of meat consumed per person was compiled from published data. The livestock marketing year was taken as the time period because the supply of meat during a livestock marketing year is a consistent whole resulting from one set of circumstances. Prices at the beginning of the period appear to be related to the total supply in much the same manner as early prices of a fruit or vegetable crop are related to the size of the entire crop. Only inspected meat production was considered because of difficulties in estimating non-inspected supplies. In addition, non-inspected supplies are mainly for local markets.

A number of measures of consumers' ability to purchase goods and services are available. These include national income, disposable income, and consumers' expenditures for food. However, they are published on a calendar year basis only. The monthly index of industrial production was selected as a measure of consumers' real income and was adapted to the livestock marketing year.

The mathematical function selected to represent the relationship is linear in logarithms. The assumption of proportional changes, resulting from expressing variables in logarithms, was assumed because of its logic and applicability to the data. It was considered likely that the change in quantity consumed associated with a given change in price varies according to the level of consumption. This was tested by graphic multiple correlation. Linearity was assumed because of the simplicity of its form, the ease with which computations

can be carried out and because neither subjective nor empirical evidence of curvilinearity was found. It was found that net relationships of the data are linear on logarithmic grids and curvilinear on arithmetic grids, indicating linearity when variables are expressed in logarithms.

The time series used in analysis are presented in Table 1. Multiple correlation was the method of analysis employed. The price per pound of all meats consumed was looked upon as a function of the quantity purchased per person and the real income of consumers. This method of analysis is consistent with the concepts of simultaneous determination and mutual interdependence of economic phenomena in the case of relatively perishable commodities, the production of which is time consuming. Supplies of such commodities, including meat, are affected by price only with a lag of time ranging from one to three years.

The multiple regression equation is:

$$\log.X_1 = 1.9438 - 1.5390 \log.X_2 + 1.0118 \log.X_3$$

In Figure 1 the net relationship between price and consumption is shown and in Figure 2 the net relationship between price and income is presented. In each case the omitted variable is held at its average value.

The coefficient of correlation R is .9431. The coefficient of determination is .8896. The standard error of the regression coefficient of X_1 on X_2 (σ_{b12}) is .2298 while the standard error of the regression coefficient of X_1 on X_3 is .1024.

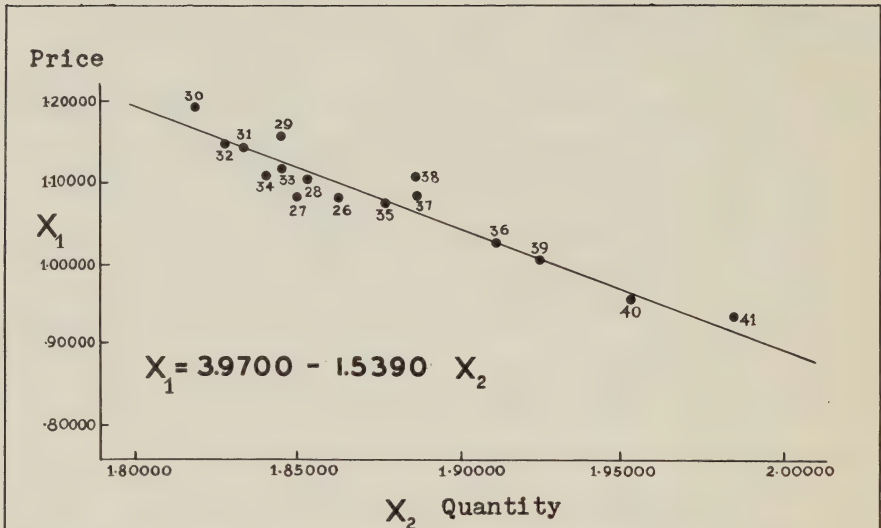


Figure 1 - Net relationship between logarithms of Price and Quantity.

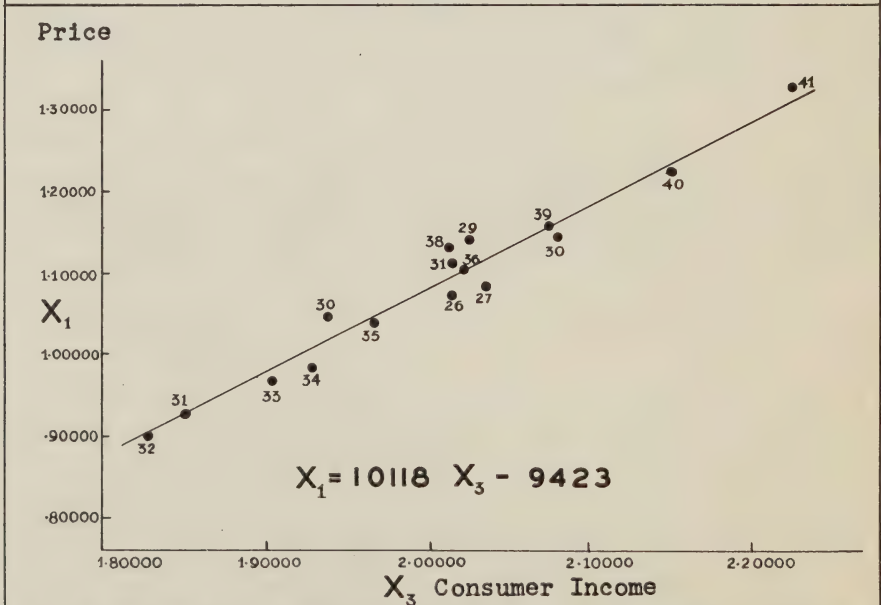


Figure 2 - Net relationship between logarithms of Price and Consumer Income.



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